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Nekite River Spawning Channel 1988 Operations

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ABSTRACT

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The Nekite River spawning channel (Central Coast District, British Columbia) has been operated for the enhancement of chum salmon since 1986. An estimated 2500 chum salmon used the channel in 1988. The run peaked on September 7. Age composition from a sample of 478 fish was 5% age 3, 77.8% age 4, 14.6% age 5, and 2.5% age 6. The sex ratio of chum salmon dead pitched from the channel was approximately 1:1. Mean egg retention was 27 eggs per female. Camp operation and efforts to get chum salmon to utilize the spawning channel are described.

RESUME

Winther, I., S.K. Bachen and R.D. Goruk. 1989. Nekite River spawning channel 1988 operations. Can. Data Rep. Fish. Aquat. Sci. 753. iii + 13 p. + Appendix.

Le chenal de frai de la riviere Nekite (district du centre côtier, Colombie Britannique) est exploité depuis 1986 dans le but de mettre en valeur la population de saumon kéta. Environ 2500 saumons kéta ont embrunté le canal en 1988. La remontee a atteint son point culminant le 7 septembre. Sur un ènchantillon de 478 poissons, 5% etalent agés de 3 ans, 77.8% de 4 ans, 14.6% de 5 ans et 2.5% de 6 ans. Le rapport male femelle parmi les poissons morts retirés du canal était d'environ 1:1. Chaque femelle avait conservé en moyenne 27 oeufs. Le present rapport décrit le fonctionnement du camp et les moyens utilisés pour que le keta emprunte le canal de frai.

INTRODUCTION

The Nekite River flows into the head of Smith Inlet at 51 25'N by 127 10'W in the Central Coast District of British Columbia (Fig. 1) and lies within the Department of Fisheries and Oceans, Canada, Statistical Area 10.

Nekite River chum salmon are the largest chum stock in Area 10 and usually enter the commercial fishing area during August to early September. This run timing allows for the harvest of any surplus when other chum and salmon stocks are not present. It also allows the harvest to take place in the outer areas of Smith Inlet where quality is good.

Chum escapements to the Nekite in the early 1980's (1980-82) have been at or near target (60,000). However, returns from these good broods were poor and insufficient to support a fishery. It is possible that poor production from these good brood years has been the result of extreme high water and flooding conditions. A spawning channel was proposed to alleviate this problem and provide a stable spawning habitat for chum salmon. The channel could also increase natural production levels. The proposal was implemented and the channel was completed in 1986.

The Nekite spawning channel is located 10 km (6 miles) upstream from the river mouth. The river runs north to south at this point and the channel parallels it with the exception of a switch back located in the lower third of the channel (Fig. 2). A road provides a dike between the river and the channel. At the north end, two culverts equipped with valves divert water from the main river to the channel. The spawning channel is 1200 m (3900') long and 8 m (25') wide with a total channel area of 9600 sq m (10800 sq yds). The total spawning area is 8060 sq m (9750 sq yds) with the remaining area devoted to deep pools and root masses. On the basis of 1.2 sq m (1.5 sq yds) per spawning pair, the channel can support 13,000 spawning chum when filled to capacity (pers. comm. SEP Engineering, 1988).

The camp is located on the north end of the high ground between the river and the channel (Fig. 2).

In 1986 fish entered and utilized the channel. Early in the run approximately 600 fish were air lifted into the channel. A total of 6000 fish spawned in the channel. In 1987, no effort was made to get chum salmon to use the channel and an estimated 400 fish spawned in the channel. The main objective in 1988 was to ensure than chum salmon utilized the channel for spawning to a greater degree.

In this report the work performed on the Nekite River spawning channel in 1988 is reviewed. Efforts to get chum salmon to utilize the spawning channel are detailed. Work required in 1989 is identified and comments on the operation of the camp are made.

METHODS

Access to the Nekite River spawning channel is via boat or float plane to the head of Smith Inlet then via 10 km of logging road travelling upstream from a log dump located in the estuary.

CAMP PREPARATION

Equipment and supplies were transported from Machmell camp (Owikeno Lake), Docee river camp and Dawsons Landing to the Nekite estuary using a Departmental work boat (Seatruck). Several trips were made from August 15 to 18 in order to get all of the equipment and supplies to the log dump.

Two All Terrain Vehicles (ATV's) were used to transport some of the gear to the camp located at the spawning channel. A helicopter was used to air lift the remainder of the gear to the camp on August 17 and 23.

Most of the time from August 15 to 24 was devoted to camp preparation. An additional room was built onto the existing cabin to house the shower, hot water tank and sink. The cabin floor, with the exception of the bedrooms, was covered with linoleum and the cabin walls were painted. A porch was erected to the entrance of the cabin. Shelves, cupboards and beds were assembled within the cabin. A storage shed was erected but was not completed.

A creek 400 m (1300') from the cabin provided water for the camp. A gravity feed system was used consisting of 4 cm (1.75") PVC pipe inserted into a rock dam. This pipe was connected to the camp plumbing.

OPERATION OF THE SPAWNING CHANNEL

Water control valves at the head of the spawning channel were opened to maximum flow on August 15.

Chum salmon were counted in the spawning channel once daily from August 21 to 31, then twice daily in the morning and afternoon from September 1 to 25, weather and water conditions permitting. Water conditions were recorded

periodically and weather conditions were reported daily. Water heights were recorded from two staff gauges; one located at the head of the channel below the culverts, and another in the river just downstream of where culverts divert water to the channel.

On August 24, two chain link fences were built and positioned in the channel. Fences were constructed of 5 cm (2") chain link mesh wired to 2 cm (.75") reinforcement bar or 5 cm (2") angle iron driven into the river bed. The sides and bottoms of the fences were held in place with rocks. The first fence was built across the top of the channel to prevent fish from escaping out through the culverts. The second was a "V" shaped fence with a 25 cm (10") opening at the apex built at the mouth of the channel to discourage fish from backing out of the channel.

Further attempts were made to get fish to utilize the spawning channel. On August 25 a 40 m (130') beach seine was used in the main river to capture chum salmon which were released into the lower end of the channel. The beach seine was pulled by hand. On August 31 a chain link fence was erected across the river just above where the channel enters the river. The fence was angled downstream from the confluence of the river and the channel to divert fish into the channel.

Fences were cleared of drift material and repaired as required. The fence in the river was completely submerged during the September 6 high water and washed out the following day. Fence materials were retrieved from the river September 11 but the fence could not be erected again. The channel fences were removed on September 26.

A dead pitch program was implemented in the channel on September 3. All chum salmon removed from the channel were sexed. Only those chum retrieved from the lower fence in the channel were sampled. Chum were also sampled from the river above its confluence with the channel. Sampling consisted of hypural length, sex, egg retention and scales. Scales were collected and sent to the Scale Lab in Vancouver.

RESULTS

Few chum salmon entered the Nekite river by August 15, however, a good showing of jumpers was observed 8 km (5 miles) down Smith Inlet on August 18. Chum were first observed in the spawning channel also on August 18. Daily counts from August 21 to September 26 appear in Table 1. The chum run peaked September 7 with a maximum count of 1640 fish in the

channel (Fig. 3).

Chum salmon entered the channel during flood conditions and were most frequently observed in the faster water. Rain and high water conditions were prevalent during much of the study (Table 2). During normal flow conditions the fish were very hesitant about entering the channel and were observed backing out of the channel to go up the main river. Chum in the channel often got past the upper fence, however, none were seen to escape through the culverts to the main river.

Only 35 chum salmon were captured when the river was beach seined: 18 males and 17 females. These fish were occupying redds in the riffle below the channel.

The first chum carcasses were collected from the spawning channel on September 3 (Table 3). A total of 1069 chum salmon, 511 males and 558 females, were dead pitched from the channel for a sex ratio of 1.09 : 1 (females : males). 237 fish were still actively spawning when the study was concluded. Not all chum salmon that were dead pitched were sampled. Samples were collected from 549 chum salmon. All of these fish were sexed and measured for hypural length. 54.5% of the fish were male and 45.5% were female. Mean hypural lengths for all fish sampled were 59.5 cm for males and 56.1 cm for females. Table 4 shows the hypural length frequency at age, the age distribution and the mean hypural lengths at age. Average egg retention measured from 218 of the 250 females sampled was 27.3 eggs. This figure appears skewed since egg retention in two of the chum salmon sampled was 1300 and 2000 eggs respectively. The mean egg retention in the remaining fish was 12.3 eggs. Hypural length, sex, age and egg retention data appears in Appendix 1.

DISCUSSION

SPAWNING CHANNEL OPERATION

Although much effort was expended getting fish to utilize the spawning channel this may not pose a problem in the future. Progeny of fish that have spawned in the channel are expected to use the channel more readily than fish which have spawned in the river. The first progeny to return to the channel will be 3 year olds from the 1986 brood year. A strict sampling regime should be undertaken in 1989 to compare river spawners to channel spawners. A larger 3 year old component might be expected in 1989 if the channel has effectively increased survival. The major effect of the channel should occur in 1990 since the majority of chum salmon return as 4 year olds.

Under normal flow conditions chum salmon would enter the spawning channel and then back out, returning to the main river to spawn. The fish were hesitant about entering the channel and once in the channel preferred areas with the steepest gradients and faster water. Chum did however spawn throughout the channel. This seemed to occur when there was a higher density of spawners in the channel. Most of the fish entered the channel during flood conditions. Another culvert at the head of the channel could increase flows which may result in chum salmon better utilizing the channel during normal water conditions.

Setting a beach seine by hand in the river proved very difficult. Due to the strong current, the seine could only be used in the riffle immediately below the channel. The main body of fish was holding in the lower end of a pool downstream from the riffle. If seining is to be used to capture fish for the channel, a boat equipped with a longer 60 m (200') seine would be most effective. This would allow large numbers of the fish holding in the lower pool to be captured and moved to the spawning channel.

More precipitation than normal caused several problems in 1988. The Nekite water shed is very steep. The system went from normal to flood conditions in hours under heavy rains. When precipitation stopped, the system dropped and cleared within a few days. During flood conditions the water in the channel became too dirty to count fish. Fish counting was also difficult or impossible when the surface of the water was broken by rain or wind.

On September 12 the lower fence in the channel was repaired. It had lifted off the bottom in high water and an unknown number of dead and dying fish were flushed from the channel. A maximum of 1640 chum salmon were counted on September 7 and 85 were dead pitched from the channel before September 7 for a combined figure of 1725 fish. It is evident that a large portion of the fish were lost during high water because at the end of the program a total of 1069 chum were recovered from the dead pitch and 237 live fish remained at the end of the study. An estimated 2500 fish spawned in the channel. More reinforcement bar should be used to support the lower fence.

CAMP OPERATION

A lack of communication facilities presented a serious problem in the Nekite camp in 1988. Basic operation of the spawning channel and the camp would benefit from the

installation of a two way radio. The lack of communication presents a potentially dangerous situation to employees at the camp should an emergency arise. The nearest communication was a VHF radio operated by shake cutters on the lower landing.

The cabin could still use paint and linoleum in the bedrooms. Chairs and two mattresses are required for the interior. A portable coal oil heater was used to heat the cabin effectively but a permanent oil heater should be installed. A 2200 liter (500 gal) water reservoir tank has to be installed above the cabin site. 300 m (1000') of 2 cm (.75") hose for a gravity feed or a pump will be required to fill the tank.

There were insufficient materials to complete the storage shed. A back wall will have to be erected in 1989 and another shelter will have to be built to house the ATV's.

Two ATV's were essential to the camps operation. Breakdowns were common so a second ATV was required for backup transportation.

BOATS AND MOORAGE

The boat moorage facilities in 1988 at the Nekite estuary were unsuitable. The Seatruck had to be anchored behind an island in the estuary and a 16' jet boat used to commute to shore. The Seatruck could be lost if the anchor line fouled and the vessel was set adrift. The jet boat had to be tied to logs which were fixed to the shore. Once the jet boat sunk when logs it was tied to hung up on high tide. The weight of the logs forced the boat under as the tide receded.

A standing boom with a float and ramp should be constructed and secured to the beach. This would provide safe moorage and make unloading boats easier. Logging operations are scheduled to begin in the area in a few years so moorage space might have to be leased in the future.

BEARS

Many bears, both grizzlies and blacks, inhabit the Nekite valley. Bear encounters were minimized by working the channel in the late morning and early afternoon. Bears were most often seen in the lower channel but presented few problems other than knocking down the fish fences. The most serious bear encounters occur on the road to camp. The road borders the river in many places and is commonly crossed by bears. Anyone travelling the road should carry a shotgun.

Table 1: Chum salmon counts in the Nekite River spawning channel.

Date 1988	# Chum am	pm	Comments
21-Aug	53		
22-Aug	38		1 pink
23-Aug			
24-Aug			Fenced channel entrance
25-Aug			Seined 35 chum into channel
26-Aug			
27-Aug			
28-Aug	280		
29-Aug	478		
30-Aug	594		
31-Aug	570		
01-Sep	629	669	
02-Sep	649	707	
03-Sep	780	1100	
04-Sep	1122	1051	
05-Sep	1333	1364	
06-Sep			Too dirty to count
07-Sep	1640	1581	1 sockeye am
08-Sep	1600	1588	1 sockeye
09-Sep	1460	1495	
10-Sep	1235	1089	Poor visibility pm - windy
11-Sep	1433	1306	
12-Sep	1030	1118	
13-Sep	1230	1259	
14-Sep	1155		pm too windy to count
15-Sep	1133	1106	pm 113 pinks
16-Sep	951	943	
17-Sep	889		pm too windy to count
18-Sep	717		pm poor visibility
19-Sep	778	814	
20-Sep	578	510	
21-Sep	722		pm too windy to count
22-Sep	499		pm poor visibility
23-Sep	505		pm too windy
24-Sep	368		pm too windy
25-Sep	366		pm rain and wind
26-Sep	237		

Table 2: Weather and water conditions for the Nekite river spawning channel, August 15 to September 26, 1988

Date	Weather	Water levels River	Channel
15-Aug	Overcast, light rain		
16-Aug	Heavy rain		
17-Aug	Rain		
18-Aug	Heavy rain		
19-Aug	Heavy rain		
20-Aug	Sunny & hot		
21-Aug	Sunny & hot		
22-Aug	Sunny & hot		
23-Aug	Sunny & hot, fog am		
24-Aug	Sunny & hot, fog am		
25-Aug	Sunny & hot, fog am		
26-Aug	Sunny & hot, fog am & pm		
27-Aug	Sunny & hot, fog am & pm		
28-Aug	Light rain am, heavy pm		
29-Aug	Heavy rain		
30-Aug	Sun, partly cloudy	0.9	
31-Aug	Sun, clear		
01-Sep	Sun, clear		
02-Sep	Sun, clear		
03-Sep	Sunny & hot		
04-Sep	Overcast am, Sunny & hot pm		
05-Sep	Overcast, light rain pm		
06-Sep	Heavy rain	6.0	5.0
07-Sep	Fog am, Sun pm		
08-Sep	Overcast, light rain		
09-Sep	Rain		
10-Sep	Sun, calm		
11-Sep	Sun, calm		
12-Sep	Sun, calm		
13-Sep	Sun, calm		
14-Sep	Heavy cloud cover, windy pm		
15-Sep	Clear, light wind		
16-Sep	Clear, calm		
17-Sep	Clear, calm		3.4
18-Sep	Heavy rain		
19-Sep	Clear, cold		4.4
20-Sep	Clear, calm		4.2
21-Sep	Clear, windy pm		
22-Sep	Overcast, rain & wind pm		
23-Sep	Clear & calm am, rain pm		
24-Sep	Rain		
25-Sep	Heavy rain		
26-Sep	Heavy rain, high wind (SE 30-40)		

Table 3: Chum salmon dead pitch, Nekite River spawning channel.

Date 1988	Daily Count Males	Females	Cumulative total Males	Females
03-Sep	4	9	4	9
04-Sep	3	9	7	18
05-Sep	7	14	14	32
06-Sep	3	7	17	39
07-Sep	6	23	23	62
08-Sep	3	23	26	85
09-Sep	5	18	31	103
10-Sep	7	15	38	118
11-Sep	6	11	44	129
12-Sep	4	10	48	139
13-Sep	10	16	58	155
14-Sep	7	14	65	169
15-Sep	65	116	130	285
16-Sep	92	89	222	374
17-Sep	62	42	284	416
18-Sep	13	11	297	427
19-Sep	17	25	314	452
20-Sep	18	11	332	463
21-Sep	12	12	344	475
22-Sep	102	61	446	536
23-Sep	10	3	456	539
24-Sep	11	4	467	543
25-Sep	10	2	477	545
26-Sep	34	13	511	558

TABLE 4: Hypural length frequency at age. Nekite River chum salmon 1988.

Hypural Length (cm)	AGE									
	Unknown		3		4		5		6	
	Males	Females	Males	Females	Males	Females	Males	Females	Males	Females
49				1		4				
50		2	1		2	5				
51		1		1		4		1		
52		4		3	2	5	1	1		
53	1	2	3		6	9		1		
54	1	3		1	7	14		1		
55	3	8		1	12	16	1	1		
56	1	9	1	2	18	28	2	2	1	
57	2	7	5		13	28	4	2		
58	3	7	1	1	20	24	2	5		
59	2	1	3		23	10	4	4	1	
60	3	2			30	14	3	3	1	
61	1	1			19	4	6		1	
62	3				14	4	4		4	
63					15	2	4	1	1	
64					5		4			1
65	3				10		5		2	
66	2				1		3			
67					2		2			
68	1				1		1			
69										
70					1		2			
TOTAL	26	47	14	10	201	171	48	22	11	1
Mean Length	59.8	55.6	56	53.5	59.1	56.2	61.7	57.1	61.4	64

Total sampled: 551
Total aged: 478

Age Distribution

Age 3:	5.0%
Age 4:	77.8%
Age 5:	14.6%
Age 6:	2.5%

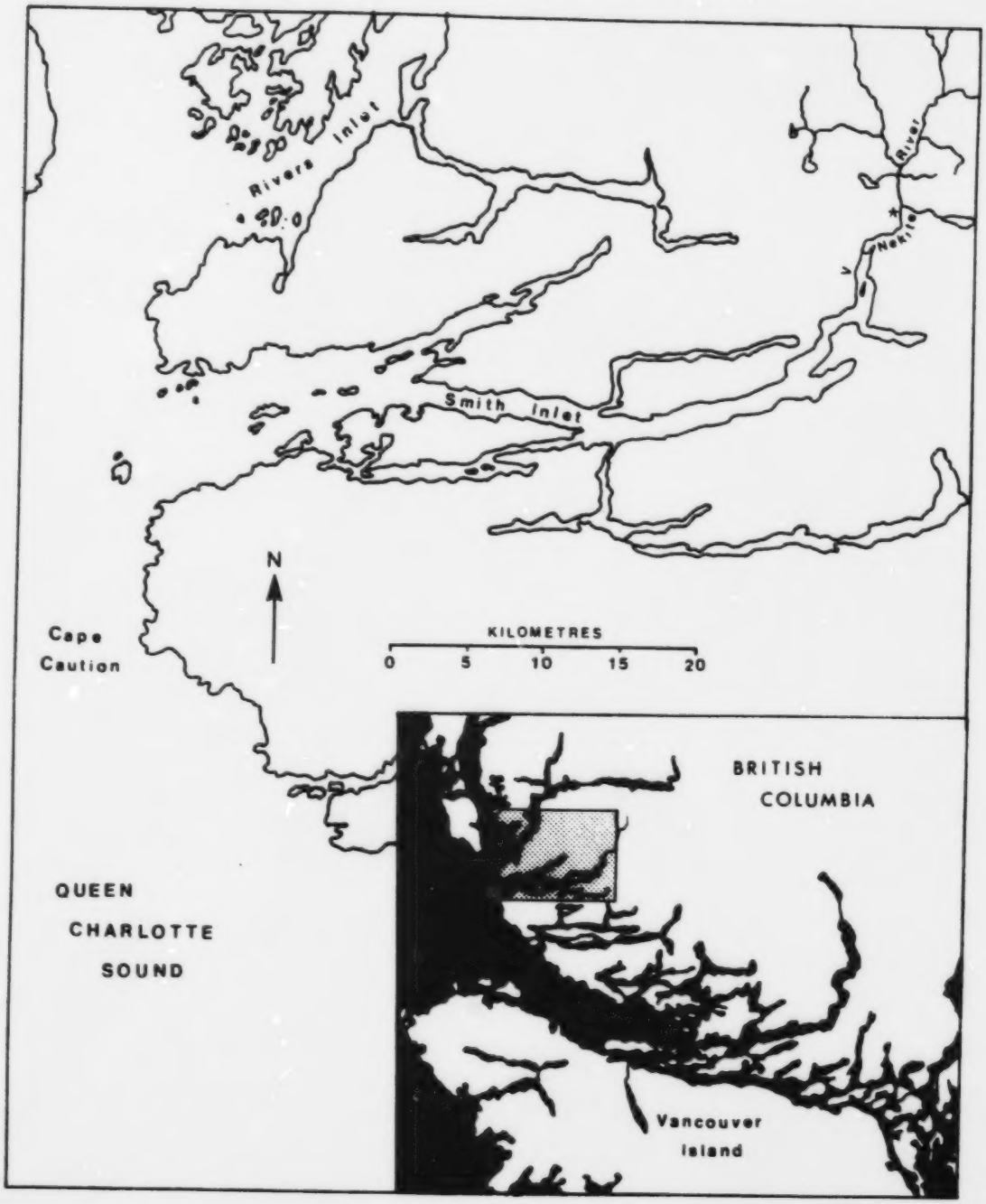

Figure 1: Location of the Nekite River, British Columbia, Canada. The > indicates the log dump and the * indicates the spawning channel site.

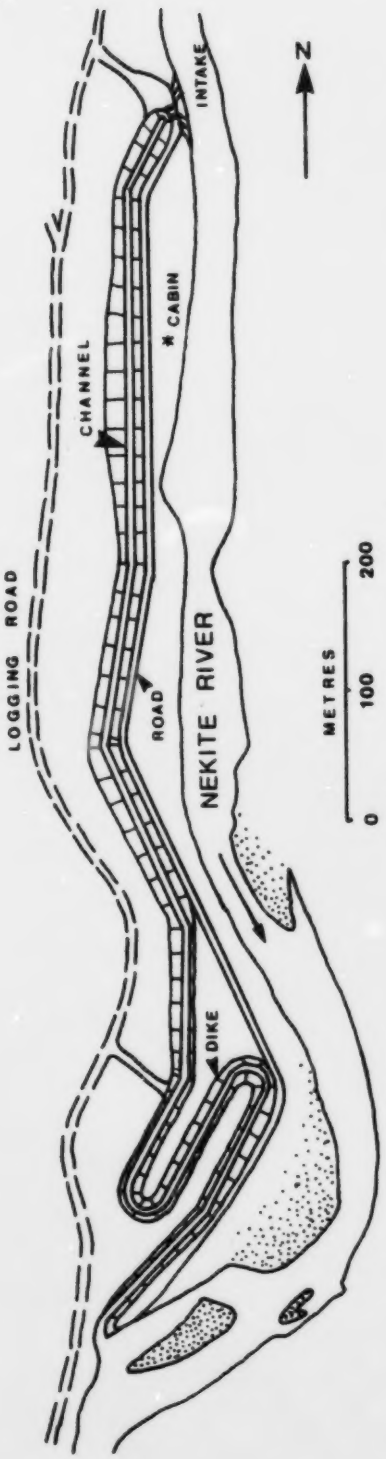

Figure 2: Detail of the Nekite River spawning channel.

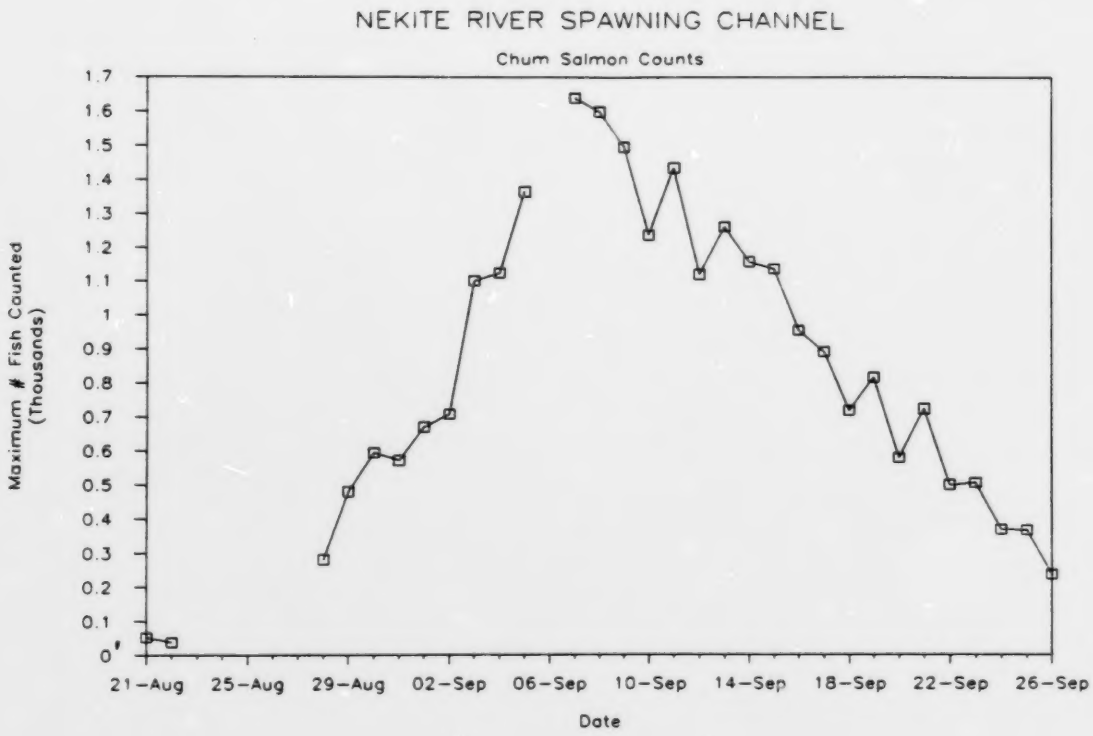

Figure 3: Plot of Maximum number of chum salmon counted in the Nekite River spawning channel per day.

Appendix 1: 1988 Nekite River chum salmon samples

Length	Sex	Egg Ret	Age	Length	Sex	Egg Ret	Age	Length	Sex	Egg Ret	Age
60.0	M		4	56.0	M		4	52.5	M		4
62.0	M		4	66.5	M		4	56.5	M		3
51.0	F	0	5	65.0	M		4	55.0	F	52	4
52.0	F	0	4	59.0	M		4	70.0	M		4
58.0	F	3	5	62.0	M		4	66.0	M		5
57.0	F	0	4	66.5	M		5	59.0	F	5	4
56.0	F	26	4	57.0	M		4	57.0	F	0	4
65.0	M		4	56.0	M		4	57.5	F	0	4
58.0	F	36	4	56.0	M		4	59.5	F	85	5
63.0	M		4	57.0	M		4	57.0	F	118	4
53.0	F	1	4	60.0	M		5	57.0	F	0	4
62.0	M		4	53.0	M		4	62.0	M		4
60.0	F	74	5	59.5	M		4	60.0	F	0	4
65.0	M		6	56.0	M		3	59.0	F	175	4
58.0	F	0	4	58.5	F	3	4	60.0	F	0	4
59.0	F	0	4	61.0	M		4	58.5	M		3
59.0	M		5	65.0	M		5	50.5	F	10	4
57.0	F	122	5	56.0	F	0	4	56.0	F	2	4
62.0	M		4	55.5	M		4	50.5	F	0	4
55.5	F	0	4	58.0	M		4				
56.0	F	4	4	57.0	M		5	58.0	F	0	4
57.5	F	0	4	58.0	M		5	57.0	F	0	4
59.0	M		3	53.5	F	2	4	52.0	F	8	4
61.5	M		6	59.0	M		4	58.0	M		4
60.0	F	44	4	64.0	M		4	60.0	M		4
								52.0	F	16	3
59.0	M		3	56.0	M		4	66.0	M		5
62.0	M		6	59.0	M		5	60.0	M		4
60.0	F	0	5	55.0	F	12	4	61.0	M		4
60.0	F	83		55.5	M		6	58.0	M		4
53.0	M		3	53.0	M		4	63.0	M		4
49.0	F	0	4	59.0	M		4	55.0	F	0	3
53.0	F	48	4	60.0	M		4	60.0	M		4
56.0	F	8	4	54.5	M		4	65.0	M		4
56.0	F	0	4	53.0	M		4	58.0	F	43	4
57.5	F	4	4	58.0	M		4	58.0	F	0	4
52.0	F	1	3	53.5	M		4	51.5	F	0	3
58.0	F	0	4	54.5	M		5	57.0	M		4
56.0	F	0	4	59.0	M		4	61.0	F	5	
57.0	F	0	4	54.0	F	12	4	61.5	F	27	4
53.0	M		4	56.0	M		5	59.0	F	0	4
49.0	F	3	3	57.5	M		4	56.0	F	0	3
56.0	F	104	4	58.0	F	2	4	56.0	F	0	4
56.0	F	4	4	59.0	M		4				
58.0	F	0	4	50.0	M		4	59.0	M		4
57.0	F	0	4	49.0	F	14	4	58.5	M		4
57.0	F	4	4	53.0	M		3	58.0	M		4
57.5	M		5					68.0	M		4
62.5	M		4	57.0	M		3	53.0	F	0	4
68.0	M		5	55.5	M		4	57.0	F	4	4
55.0	F	3	4	55.0	F	10	4	63.0	F	4	5
				53.0	F	0		56.5	F	0	4
58.0	F	0	4	64.0	M		5	58.0	F	13	4
56.0	F	142	3	54.0	F	0		56.0	F	2	4

Appendix 1: Continued.

Length	Sex	Egg Ret	Age	Length	Sex	Egg Ret	Age	Length	Sex	Egg Ret	Age
51.0	F	0	3	57.0	M		5	64.5	M		4
54.0	F	4	3	57.0	M			56.5	F	1	4
58.0	F	1	4	59.0	M		5	60.0	M		4
55.0	F	0	4	55.5	M		4	64.5	M		4
57.0	F	36	4	54.5	M		4	56.0	F	3	4
				50.0	F	6	4	61.0	M		4
63.0	M		4	60.0	M		4	61.0	F	1	4
57.0	F		5	55.0	M		4	58.0	F	1	5
56.0	F		4	54.0	F	10	4	62.5	F	0	4
54.0	F		4	61.0	M		4	56.0	F	0	4
52.0	M		4	58.0	M		4	54.0	F	1300	4
59.0	M		5	57.5	F	0		62.0	M		4
58.0	F		4	55.0	M			70.0	M		5
57.0	M		4	55.0	F	1		56.5	M		3
56.0	M		4	58.0	M		4	61.0	M		5
59.5	M		4								
66.5	M		5	49.0	F	12	4	65.0	M		
60.0	M		4	52.0	M		4	57.5	M		4
61.0	M		4	60.5	M		4	58.0	F	0	4
61.0	M		5	56.0	M		4	58.0	F	16	4
54.0	F		4	50.0	M		3	58.0	F	0	3
61.0	M		5	58.0	M		4	64.0	F	37	6
60.0	M		4	56.0	M		4	57.0	M		3
60.0	M		4	52.0	F	2	4	54.0	F	3	4
58.0	F		4	51.0	F	0	4	61.0	F	34	4
70.0	M		5	57.5	M		4	60.0	M		4
57.0	M			62.5	M		5	58.0	M		4
56.0	M		4	55.0	F	0	4	60.0	F	1	4
52.0	F			50.0	F	16	4	55.0	F	1	4
60.0	M		4					57.0	F	0	4
64.0	M		4	60.0	M		4	57.0	F	0	4
				57.0	M		4	53.0	F	0	4
63.0	M		4	54.0	F	3	4	62.0	F	0	4
60.0	M			54.0	F	0	4	65.0	M		4
56.5	M		4	61.0	M		4	55.0	F	4	4
56.0	F		4	57.0	M		4	61.0	M		4
52.0	F		4	54.5	M		4	59.0	F	6	4
60.0	M		4	54.5	M		4	56.0	F	3	4
54.0	M		4	54.0	M		4	63.0	M		4
57.5	M		4	50.5	F	2	4	54.5	F	0	4
57.0	M		4	56.5	M		4	54.5	F	6	4
54.0	F		4	54.5	M						
54.0	M		4	61.5	M		5	60.0	M		
57.0	M		4					57.0	F	6	4
60.0	M		4	57.5	M		4	57.0	M		3
59.0	F		5	61.5	M		4	63.0	M		4
62.0	M		4	57.0	M		5	57.0	F	9	4
59.0	F		5	61.0	M		5	58.0	M		3
56.0	F		4	57.0	F	12	4	55.0	F	0	4
56.0	M		4	55.0	M		4	63.0	M		4
60.0	M		4	58.5	M		4	60.0	M		4
60.0	M		4	56.5	M		4	64.0	M		5
61.0	M		4	50.0	F	134	4	58.5	M		4
65.0	M		5	61.0	M		4	60.0	M		4

Appendix 1: Continued.

Length	Sex	Egg Ret	Age	Length	Sex	Egg Ret	Age	Length	Sex	Egg Ret	Age
65.0	M			54.5	F	0	4	57.0	F	0	4
54.0	F		5	57.5	F	1	4	53.5	F	61	4
61.0	F		4	56.5	F	4	4	55.5	F	0	5
				59.0	M		4	55.0	F	0	4
55.0	F		4	55.0	M		4	59.0	F	19	4
58.0	M		4	55.0	M		4	60.0	F	1	4
59.0	F		4	56.0	F	3	4	63.0	M		4
55.0	F		5	57.0	F	13	4	60.0	F	4	4
56.0	F		4	60.0	F	7	4				
60.0	M		4	58.5	M		4	56.0	F	14	4
56.0	M		4	62.0	M		4	60.0	M		4
58.5	M			52.5	F	2	4	59.0	F	0	4
58.5	M		4	65.0	M		5	57.0	F	0	4
53.0	F		4	58.0	F	4	4	57.0	F	2	4
55.0	M							57.5	M		4
55.5	F		5	53.0	F	0	4	59.0	M		6
56.0	M		4	63.0	M		4	65.0	M		5
56.0	M			50.0	M		4	62.0	F	12	4
59.0	M		4	60.0	M		5	53.5	F	1	4
50.0	F		4	58.0	M			62.0	M		6
52.0	M		5	53.0	F	7	5	61.0	M		4
54.0	M		4	60.0	M		4	62.0	M		4
59.0	M		4	60.0	M		5	57.0	F	1	4
62.0	M		5	54.0	M		4	57.5	F	1	5
60.0	M		4	60.0	F	2	4	54.0	F	63	4
61.5	M		4	62.0	M		6	62.0	M		4
61.0	M			59.0	M		4	63.0	M		5
55.0	M		4	58.0	M		4	56.0	F	20	4
52.0	F		5	56.0	M		4	57.0	F	0	4
				55.5	F	1	4	56.0	F	2	4
53.0	M		4	58.0	M		4	61.0	M		5
54.0	M		4	60.0	F	0	4	61.0	M		6
59.5	M		4	58.0	F	2	4	52.0	F	0	4
61.5	M		4								
57.0	M		4	63.0	M		5	57.0	F	0	
61.0	M		4	60.0	F	2	4	57.0	F	8	
65.0	M		4	55.5	F	2000	4	56.0	F	46	
63.0	M		6	64.5	M		6	53.0	F	0	
59.5	M		4	59.5	F	1	4	50.0	F	78	
50.0	F		4	56.0	M		5	60.0	F	0	
65.0	M		4	60.0	F	6	4	54.0	M		
58.0	F		4	65.0	M		4	59.0	F	0	
57.5	M		4	63.0	F	6	4	62.0	M		
60.0	M		4	53.0	F	0	4	52.0	F	0	
59.0	M		4	55.0	F	3	4	58.0	F	1	
56.0	M		4	63.0	M		5				
55.0	M		4	59.5	M		4	57.0	F	4	
59.0	M		4	57.0	F	0	4	57.0	F	0	
60.5	M		4	57.0	M		5	56.0	F	0	
61.0	M		4	65.5	M		5	58.0	F	4	
59.0	M		4	55.0	F	0	4	56.0	F	118	
62.0	M		5	56.0	F	11	4	49.5	F	1	
61.0	M		5	63.0	M		4	57.0	F	0	
59.0	F		5	57.5	F	2	5	53.0	M		

Appendix 1: Continued.

Length	Sex	Egg Ret	Age
53.0	F		4
56.5	F		4
57.5	F		5
61.5	M		5
63.0	M		4
57.5	M		4
55.0	M		4
58.0	M		
67.0	M		4
55.5	M		4
61.0	M		4
61.0	M		4
56.0	F		4
54.0	F		4
63.5	M		5
57.0	M		4
62.0	M		
58.5	M		4
63.5	M		4
55.0	M		4
60.5	M		4
59.5	M		6
64.0	M		5
60.5	F		4
62.5	M		4
61.0	M		4
49.0	F	5	4
59.0	F	1	5
59.0	M		4
58.0	F	3	4
65.0	M		5
66.0	M		4
59.0	M		4
59.0	M		4
56.0	M		4
62.0	M		4
61.0	M		4
57.0	F	2	4
64.0	M		4
63.0	M		4
59.5	F	3	4
59.0	M		4
56.0	F	1	4
65.0	M		4
58.0	F	0	4
53.0	M		3
60.0	M		4
57.0	F	0	4
60.0	F	0	4
59.0	F	0	4
61.5	F	0	4
64.0	M		4
62.5	M		4
56.0	F	2	
56.0	F	81	
55.0	F	2	
56.0	F	0	
55.0	F	12	
56.0	F	0	
60.0	M		
54.0	F	0	
56.0	F	0	
51.0	F	8	
58.0	F	160	
58.0	M		
62.0	M		
57.0	F	0	
55.0	F	42	
57.5	F	0	
68.0	M		
55.0	F	2	
55.0	F	0	
55.0	F	0	
57.0	F	0	
55.0	F	0	
56.0	F	78	
52.0	F	12	
51.5	F	19	
54.0	F	4	
58.0	F	2	
66.0	M		
59.0	M		
66.0	M		
65.0	M		
58.0	F	0	